1,033,603

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,033,603

Date of Application and filing Complete Specification July 8, 1963.
No. 26975/63.
Application made in Sweden (No. 765) on July 9, 1962.
Complete Specification Published June 22, 1966.

Index at acceptance:—E1 F(31B, 31D1, 31D2, 31E, 31F, 43B)
Int. Cl.:—E 21 b 43/10

COMPLETE SPECIFICATION

Improvements in Rock Drilling Equipment

We, ATLAS COPCO AKTIEBOLAG, of Nacka, Sweden, a company registered under the laws of Sweden, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to rock drilling equipment particularly intended for drilling in rock covered by an overburden layer of soil, moraine, filling material or the like. The drilling equipment according to the invention may also be used for drilling into the bottom of waterways or for drilling holes under water through material covering the bottom and into the underlying rock. The invention may also be used for drilling holes for various types of piles, for telephone or power line poles, road sign poles, and the like. The rock drilling equipment according to the invention comprises generally a tubular casing, a rock drill bit and drill rod means carrying said drill bit at one end arranged for passage and movement all the way longitudinally into and through said tubular casing and retractable out of said tubular casing, means for transmitting drilling energy to said drill rod means at an end opposite the end carrying the drill bit, means for transmitting feeding force to the tubular casing for feeding it into a hole, and guiding means arranged in said tubular casing adjacent the leading end of the tubular casing and arranged to guide the drill bit for movement eccentrically to the tubular casing axis on a path clearing the way for the tubular casing and producing an undercut for the tubular casing and a hole slightly larger in diameter than the outer diameter of the tubular casing and said guiding means being arranged to permit movement of drill rod means from ground level down through the whole tubular casing through said guiding means to drill beyond the tubular casing.

The rock drill bit used in connection with the invention may be a hammer drill bit, a rotary drill bit, a rolling drill bit, a diamond bit or another type of drill bit that may be fit for the kind of ground and rock to be drilled.

In the accompanying drawings some embodiments of the invention are illustrated by way of example. Fig. 1 is a longitudinal section of a main adapter and flushing medium supply head as well as of the upper end of a tubular casing and a side view of the upper end of a drill rod means according to the invention. Fig. 2 is a transverse section on lines II—II in Fig. 1. Fig. 3 is a longitudinal section and partial side view of the lower end of a tubular casing and drill string. Fig. 4 is a cross section on line IV—IV in Fig. 3. Fig. 5 is a section similar to Fig. 3 with the drill string in retracted position and Fig. 6 is a cross section on line VI—VI in Fig. 5. Fig. 7 is a section similar to Fig. 3 of a modification of the casing and drill string according to Figs. 3—6, and Fig. 8 is a cross section on line VIII—VIII in Fig. 7. Fig. 9 is a longitudinal section similar to Fig. 7 with the drill string in retracted position, and Fig. 10 is a cross section on line X—X in Fig. 9. Fig. 11 is a side view of the drill bit end of a casing and drill steel according to a further embodiment of the invention, and Fig. 12 is a longitudinal section and partial side view of the upper end of the casing and drill steel according to Fig. 11 Fig. 13 is a cross section on line XIII—XIII in Fig. 12, and Fig. 14 is a section on line XIV—XIV in Fig. 11 Fig. 15 is a view similar to Fig. 11 in which the drill steel has been retracted into the casing.

The rock drilling equipment illustrated in Figs. 1—10 consists of a main adapter 1 which in conventional manner, for instance by means of a shank having two or more radial rotation lugs often called a Leyner shank, is arranged for being actuated by a

rock drill (not illustrated) which may be a rotary rock drill or a rock drill with rotary as well as hammering action. The rotary or hammering and rotary energy is transmitted through the main adapter to a drill string or to an integral drill steel. The drill rod means may comprise a number of drill rod elements 2 coupled together by means of sleeves 3 and a bit adapter 4. At the leading end the bit adapter is coupled to a drill bit 5, which according to the working conditions may be a hammer drill bit provided with hard metal inserts, a roller bit, a diamond bit or any other suitable drill bit. The drill rod means and the bit is carried through a tubular casing 6 which may comprise a number of tubular casing elements which may be threaded together directly as illustrated in the drawings or connected by means of coupling sleeves or otherwise as is well known in the art. The leading casing element 7 is of a special design and in the embodiment of Figs. 3—6 the leading element 7 forms a bearing surface 8 for a bushing 9 and an annular abutment or shoulder 10 which prevents the bushing 9 from being expelled through the lower end opening of the casing element 7. The bushing 9 has an eccentrically disposed non-circular passage or opening which is partially cylindrical and partially hexagonal and which may, for instance, as illustrated in Figs. 4 and 6 comprise one half 11 of a circle and one half 12 of a hexagon, as illustrated at 11 and 12. The bit adapter 4 is provided with an eccentric guiding boss 13 which fits the opening 11, 12 so that it can move axially through said opening but is prevented from turning in the bushing 9. The bit adapter has a flushing medium passage 14 which communicates with the flushing medium passage 15 in the drill rod elements 2 and flushing medium passages 16 in the drill bit. The bushing 9 may have one or more recesses 17 in the peripheral portion forming longitudinal passages through which flushing medium may pass from the passage 18 between the drill rod string 2 and the casing element string 6 in the direction towards the drill bit or in opposite direction. The external diameter of the bushing 9 is so much less than the minimum internal diameter of the casing element 6, that the bushing 9 may be retracted through the string of casing elements together with the drill rod string and the bit. The bit adapter 4 is furthermore so dimensioned and the guiding boss 13 is so disposed on the bit adapter, that the drill bit and the drill rod string may be moved down through the casing string 6 with the drill bit moving substantially along the axis of the casing and during this motion the bushing 9 is situated substantially around the portion 19 of the bit adapter 4 as illustrated in Fig. 5. In this relative position of the various parts the drill string including the bushing 9 and bit 5 may be moved down through the casing string until the bushing 9 abuts the shoulder 10 of the leading casing element 7. The drill string is then moved forward a further distance so that the boss 13 enters the opening in the bushing 9 and so that consequently the drill bit arrives outside the end 20 of the casing element 7, as obvious from Fig. 3. Since the boss 13 has entered the opening in the bushing 9 and the bit adapter has been caused to take an excentric or offset position in casing element 7 the drill bit will now operate in front of and slightly outside the prolongation of the casing element 7, as illustrated in Fig. 3. In this position the drill bit will produce a hole 21 which is slightly larger than the external diameter of the casing element 7. The bushing 9 has a partial upper extension 39 which guides the bit adapter 4 in the bushing in the position illustrated in Fig. 5. The boss 13 has tapering end portions 22, 23 which are helpful when the boss has to enter the bushing 24. The opening 11,12 in the bushing is so large, that it permits passage of a coupling sleeve 3 in any direction.

At the upper end of the string of casing elements 6 a flushing medium bushing 25 is provided which is screw threaded into the trailing casing element 6 and is provided with a swivel bushing 26 arranged on the outside of the flushing medium bushing for supplying flushing medium through a connection 27 and passage 28 to the passage 18. The main adapter 1 is provided with an annular end surface 29 which abuts the upper end surface 30 of the bushing 25 through which a feeding pressure or feeding force may be transmitted to the string of casing elements so that said string is hammered or pressed down through the ground according to the advance of the drilling. However, rotation cannot be transmitted from the main adapter 1 to the sleeve or bushing 25 and in order to prevent that the bushing 25 rotates due to friction an arresting mechanism is provided which consists of a spring actuated pawl illustrated in section in Fig. 2 and cooperating with teeth 32 on the bushing 25. Percussion energy and pressure may be transmitted from the adapter 1 through a shoulder 33 to the upper end surface 34 of the trailing drill rod element 2 and furthermore through end surfaces 35, 36 to the bit adapter 4 and through end surfaces 37, 38 to the drill bit 5.

When the drilling equipment above described has been used to drill a hole through the overburden down to bed rock the drill string and the bushing 9 may be retracted through the casing string from which the bushing 25 has been removed. Drilling may then continue with a conventional drill string without the adapter 4 and bushing 9 through the casing string to any desired depth in bed

rock. Drilling may also be continued without retracting the drill string if a rod element 2 is added at the upper end of the drill string since the boss 13 may follow the drill bit down through the hole and the sleeve 3 may pass through the opening 11,12 in the bushing 9. In the modification of the invention illustrated in Figs. 7—10 the bushing 9 is arranged to remain substantially still without rotating in the new casing element 7 during drilling and in this case the bit adapter 4 is provided with an excentrically disposed or off set guiding boss 42 of circular cross section which is mounted for rotation in the cylindrical opening 40 in the bushing 41, Fig. 8. The other details of the embodiment in Figs. 7—10 have been indicated with the same reference numerals as in Figs. 3—6 and are not described again.

The embodiment of the invention illustrated in Figs. 11—15 is particularly useful for relatively short holes such as telephone pole holes, holes for road sign posts, or the like. In this embodiment the illustrated equipment comprises a tubular casing 50 which is recessed at one side of the leading end as indicated at 51 so that a side opening is formed at this end of the casing. The casing is illustrated in the present case as a one piece casing but for longer holes the casing may naturally be built up by several casing elements, screwed together or connected in any other suitable way. An integral drill steel such as a hexagon drill steel 52 provided with a cruciform drill bit 53 and a conventional hexagon shank 54 and a collar 55 extends through the casing 50. A split bushing 56, 57 which has a hexagonal opening 58 and external flange portions 59, 60 is inserted in the upper end of the casing 50 around the drill steel, as illustrated in Figs. 12 and 13. The bushing portion 57 forms a lug 61 which engages a corresponding recess 62 in the upper end of the casing 50 so that the bushing 56, 57 can not rotate in the casing. The underside 63 of the flanges 59, 60 engages the end surface 64 of the casing, whereas the collar 55 is normally pressed against the upper surface 65 of the flange 59, 60 which is preferably rounded to fit the collar 59. At the leading end of the casing 50 a crescent shaped guide body 66 is welded or otherwise secured to the inner side of the wall of the casing 50. Said guide body is so dimensioned that the drill bit, when moved to the bottom of the casing, rides out somewhat outside the casing on the guide body. During drilling the drill steel as well as the casing is rotated by the rock drill and it is obvious that the drill bit will produce a hole 67 which is slightly larger than the external diameter of the casing. The drill steel is slightly bent during drilling as obvious from Fig. 11 but it has been found that the usual clearance in drill chucks and the elasticity of the drill steel is quite sufficient to permit this minor bending. Flushing of the drill hole is in this embodiment carried out in conventional manner, for instance by air flushing through the flushing passage 68 of the drill steel.

The embodiments of the invention above described should only be considered as examples and may be modified in several different ways within the scope of the claims.

WHAT WE CLAIM IS:—

1. A rock drilling equipment comprising a tubular casing, a rock drill bit and drill rod means carrying said drill bit at one end arranged for passage and movement all the way longitudinally into and through said tubular casing and retractable out of said tubular casing, means for transmitting drilling energy to said drill rod means at an end opposite the end carrying the drill bit, means for transmitting feeding force to the tubular casing for feeding it into a hole, and guiding means arranged in said tubular casing adjacent the leading end of the tubular casing and arranged to guide the drill but for movement eccentrically to the tubular casing axis on a path clearing the way for the tubular casing and producing an undercut for the tubular casing and a hole slightly larger in diameter than the outer diameter of the tubular casing and said guiding means being arranged to permit movement of drill rod means from ground level down through the whole tubular casing through said guiding means to drill beyond the tubular casing.

2. A rock drilling equipment according to claim 1, in which an eccentric boss is provided on the drill rod means adjacent the bit cooperates with the guide means which comprise a bushing in the tubular casing adapted to slidingly receive said boss in a position with the axis of the drill rod means offset to the tubular casing axis so much that the bit extends just outside the external diameter of the tubular casing.

3. A rock drilling equipment according to claim 2, in which the boss has a non-circular outer cross-section contour and in which the bushing has a corresponding opening for receiving the boss and preventing rotation of the boss in the bushing, the bushing having a cylindrical external bearing surface arranged for rotation in and fitting an axial opening in the tubular casing.

4. A rock drilling equipment according to claim 2, in which the boss has a circular outer cross section contour and in which the bushing has a corresponding opening for receiving the boss and rotatably journalling the boss in the bushing, the bushing having an external surface fitting in an axial opening in the tubular casing.

5. A rock drilling equipment according to claim 1, in which the tubular casing is arranged to be rotated and has a side open-

ing at the end adjacent the drill bit and in which the guide means comprises a body forming a bearing means at the opposite inner side of the tubular casing to said side opening arranged to guide the drill bit sideways out through the side opening to produce a hole slightly larger in diameter than the outer diameter of the tubular casing.

6. A rock drilling equipment according to claim 2, in which an abutment means is provided inside the casing to cooperate with the bushing to maintain the bushing within the casing in guiding position adjacent the drill bit.

7. A rock drilling equipment according to claim 6, in which the abutment means consists of an annular shoulder at the inner side of the casing arranged to cooperate with the bushing to prevent the bushing from being expelled through the casing.

8. A rock drilling equipment according to claim 2, in which the drill rod means comprises drill rod sections and coupling sleeves arranged to connect adjacent section ends and in which the bushing has an axial opening for slidingly receiving the boss and large enough to permit said coupling sleeves to pass axially through said bushing.

9. A rock drilling equipment according to claim 2, in which the guide boss is carried by a bit adapter forming a part of the drill rod means, said guide boss having a tapering portion at both ends.

10. A rock drilling equipment according to claim 1, in which a main adapter is attached to the drill rod means at an end opposite the drill bit end, said main adapter having coaxial end surfaces for transmitting percussion energy to the drill rod means and to the casing and a screw threaded portion for transmitting rotation and feeding and retraction force to the drill rod means.

11. A rock drilling equipment according to claim 10, in which a flushing medium bushing is attached to the casing end remote from the drill bit and a swivel bushing is arranged on the outside of said flushing medium bushing for supplying flushing medium to passages in said flushing medium bushing and the interior of the casing from a source of flushing medium.

12. A rock drilling equipment according to claim 5, in which the drill rod means has a collar and a non-circular portion adjacent the end opposite the bit end, a split bushing fitting around said non-circular portion to prevent relative rotation of said bushing and said portion, said split bushing fitting in the casing end opposite the drill bit end and said split bushing being arranged to entrain the casing in rotation when the split bushing is rotated.

13. A rock drilling equipment according to claim 12, in which the split bushing has an external cylindrical portion fitting in the casing, a radial flange extending outside from said cylindrical portion and having an annular surface abutting an annular end surface on the casing for transmitting axial pressures and a lug cooperating with a recess in the casing wall for entraining the casing in the rotation of the split bushing.

14. A rock drilling equipment substantially as hereinabove described with reference to the accompanying drawings.

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Leamington Spa: Printed for Her Majesty's Stationery Office by the Courier Press.—1966.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

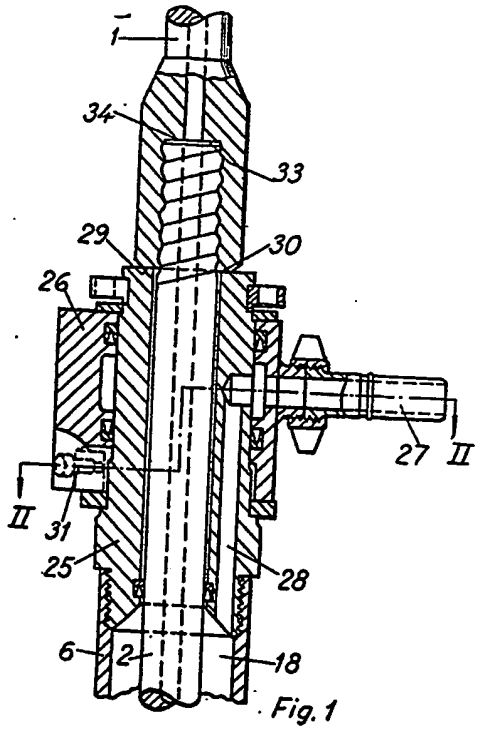

Fig. 1

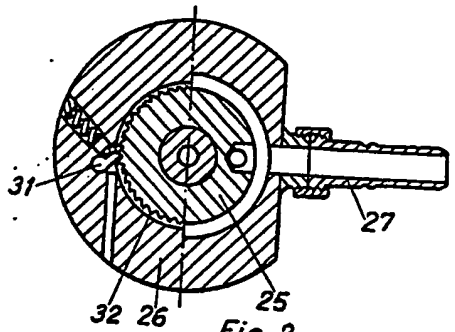

Fig. 2

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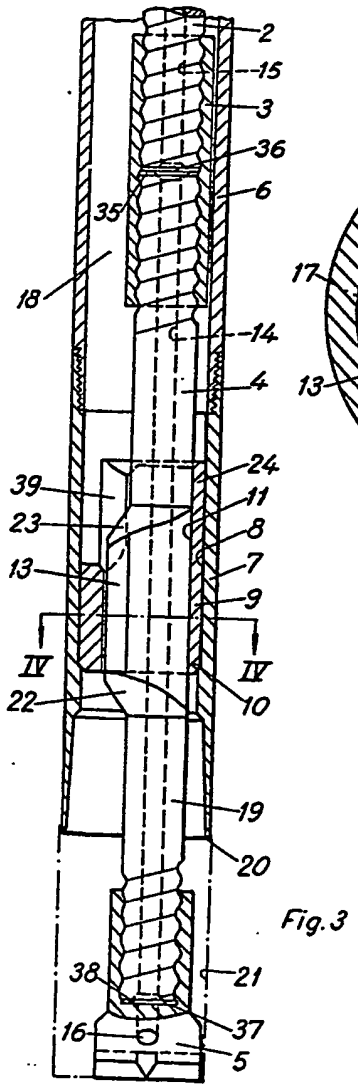

Fig. 3

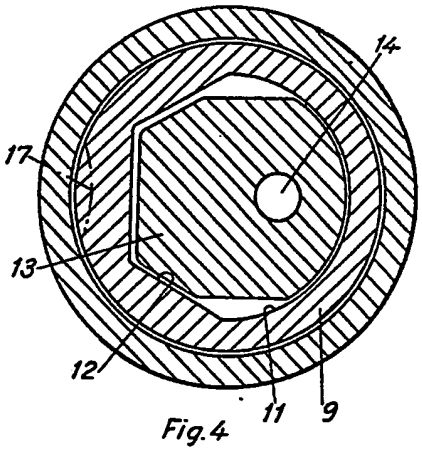

Fig. 4

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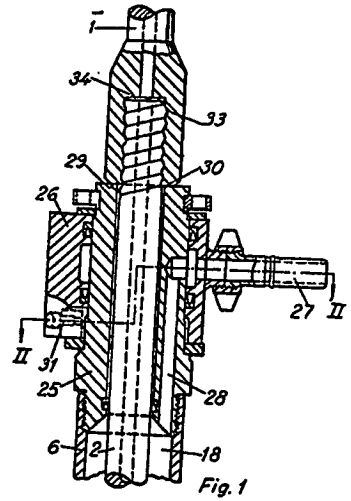

Fig. 1

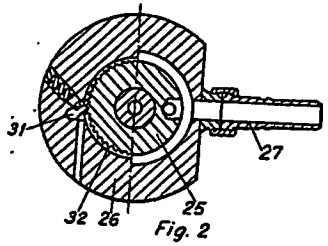

Fig. 2

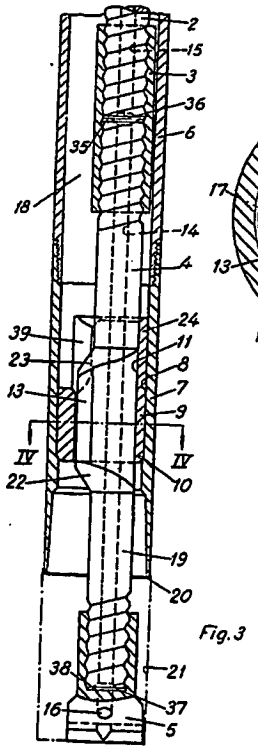

Fig. 3

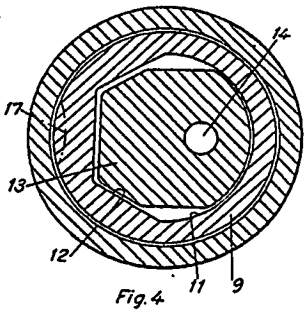

Fig. 4

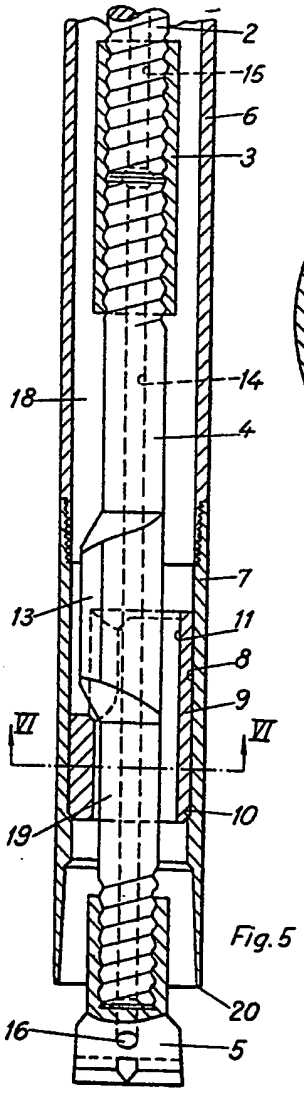

Fig. 5

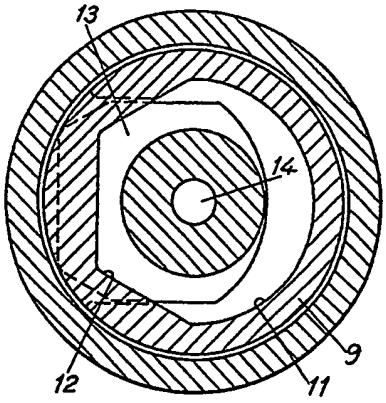

Fig. 6

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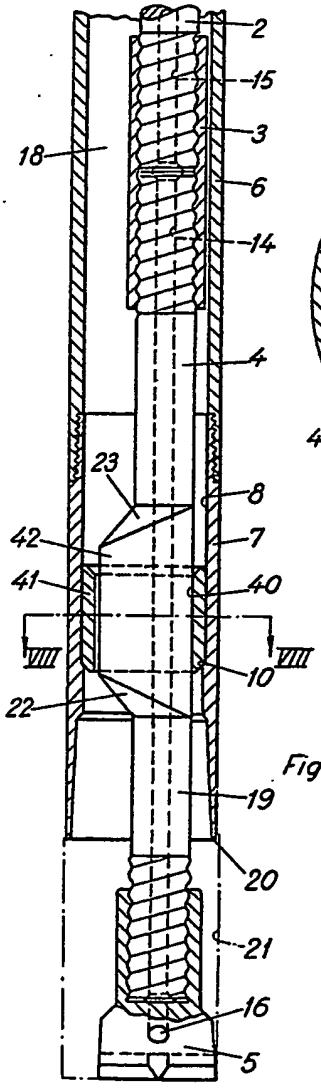

Fig. 7

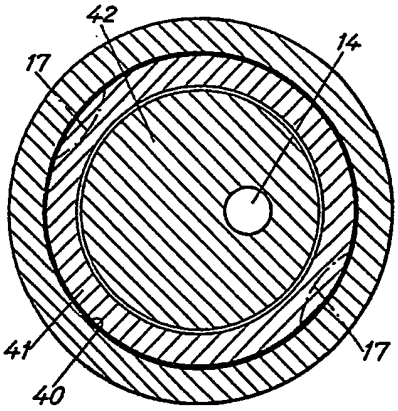

Fig. 8

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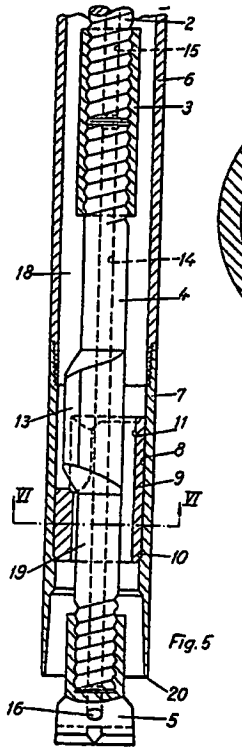


Fig. 5

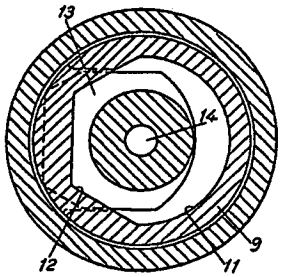
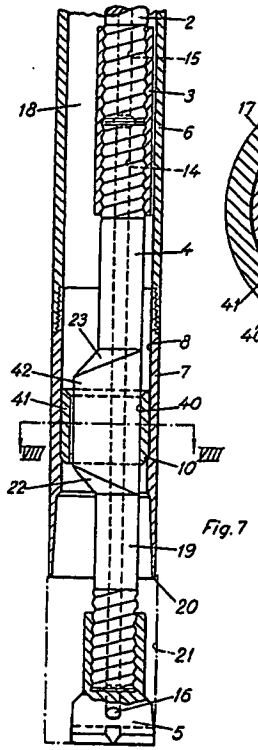


Fig. 6



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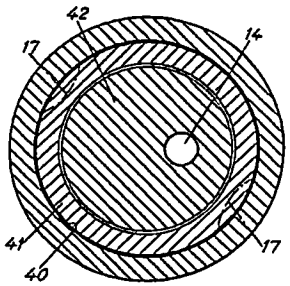

Fig. 8

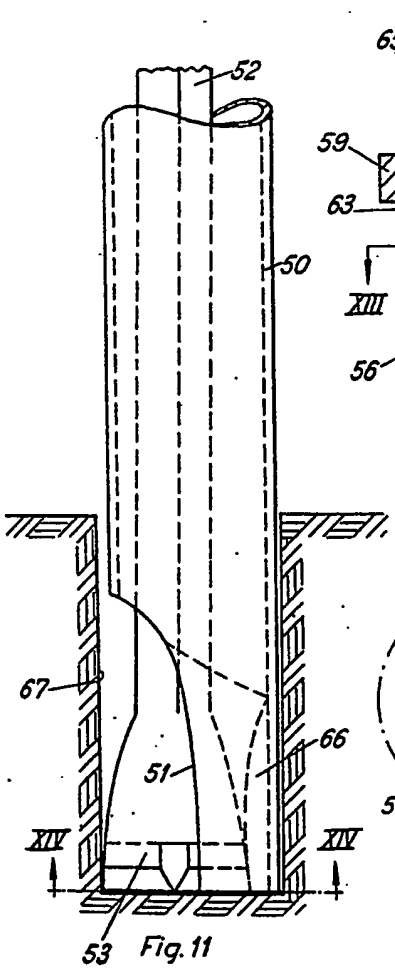

Fig. 11

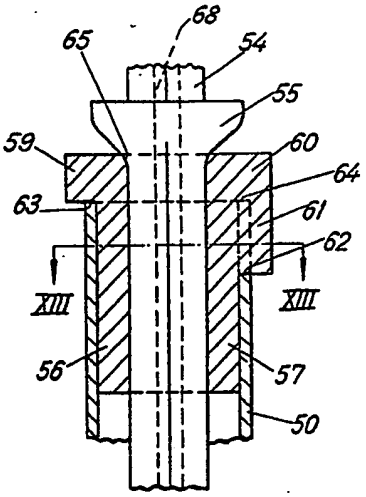

Fig. 12

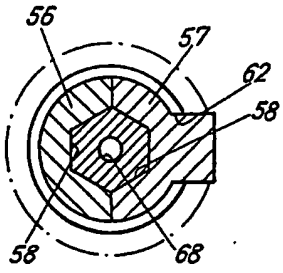

Fig. 13

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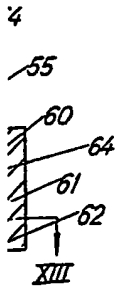

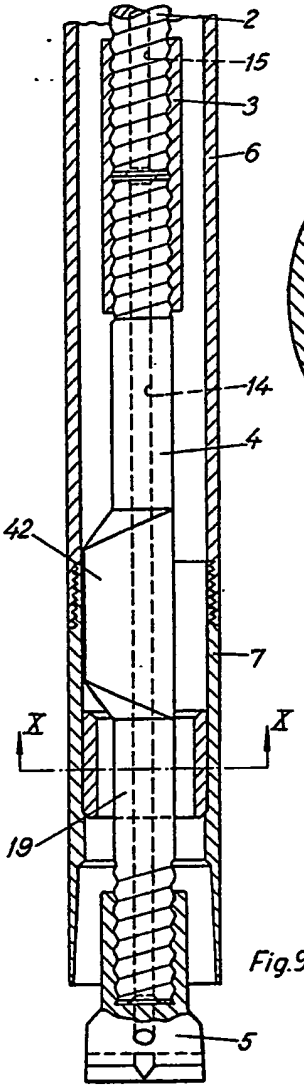

Fig.9

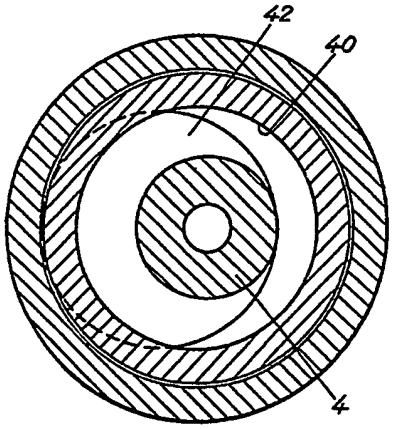

Fig. 10

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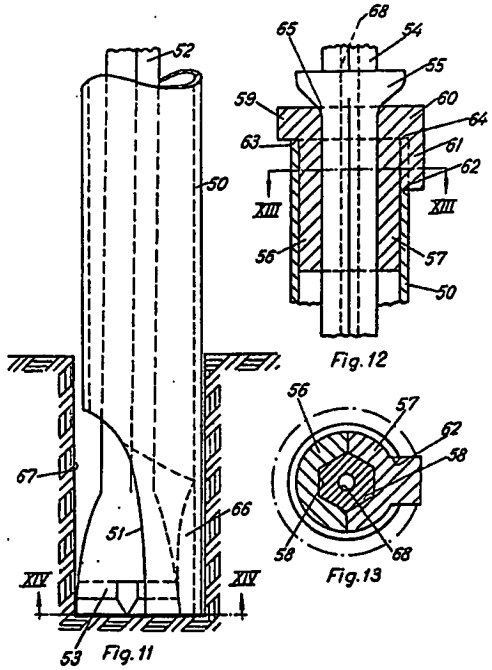

Fig. 11

Fig. 12

Fig. 13

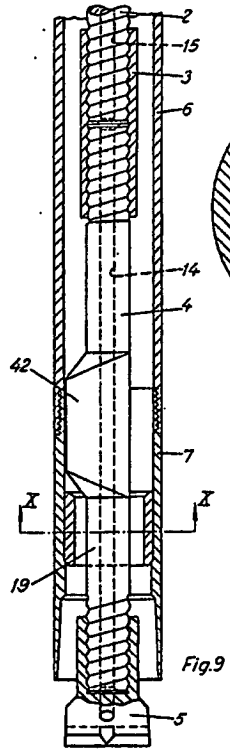

Fig. 9

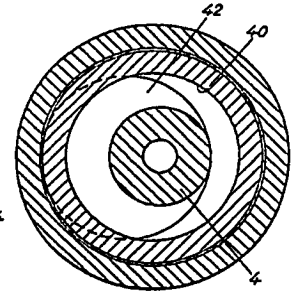

Fig. 10

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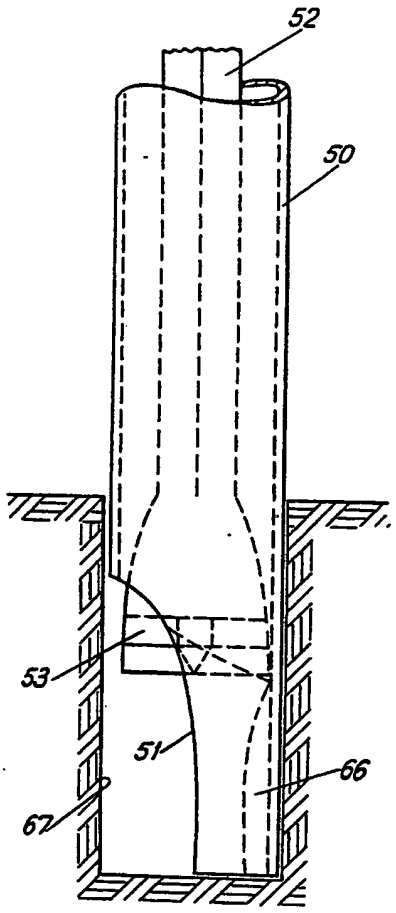

Fig. 15

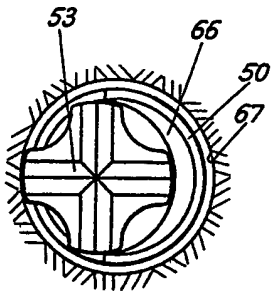

Fig. 14